"Give me some sugar!": rhythm and structure of sharing in a Namibian community

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Abstract

Cooperation and the emergence of social order are two key problems in the social sciences. This paper tests two models (kinship and reciprocity) to explain the selection of sharing partners among the Damara and Nama in Namibia. The second part of the paper deals with the social order that emerges from local exchange rules. Recently network science has demonstrated that many networks share one fundamental property: they are *scale free*. Exchange networks among the Damara and Nama differ in many ways from this commonly observed typology. The overall network is better connected, less centralized and less vulnerable than most *scale free* networks. Simulations show that these properties emerge from the most salient cultural sharing norm: reciprocity.

Keywords: Social Network Analysis, Ethnography, Namibia, Simulation

Introduction

The emergence of social order from exchange is a classical theoretical problem in social anthropology. M*au*ss, Lévi-Strauss, and Sahlins labeled these transfers “gift”, “exchange”, and “reciprocity” and made them the foundation of their respective social theories (Lévi-Strauss 1969 [1949]; Mauss 1925; Sahlins 1965). In more recent discourses the term “sharing” has won recognition over these forerunners as a more general concept to describe transactions between two or more actors (Kishigami 2004). Recent literature in anthropology and demography has very convincingly shown how actors create kinship and kinship-like relationships through sharing of food, substances and children. The intention, to create linkages and to position oneself in the wider kinship network, is often a major motivation for the transaction (Carsten 2004; Dyson and Moore 1983; Weismantel 1995).

Local rules constitute one end of social organization, global structures the other. Starting in the 1940s and 1950s Anthropologists employed and developed network analysis as an important conceptual, methodological, and theoretical tool to study social organization beyond the domain of kinship. For Anthropologists this interdisciplinary venture became a new impetus from the 80s onward, when new computational and analytical tools became available (Johnson 1994). It continues to prove a very powerful means to describe social organization and to test hypotheses about the factors that constitute it (Schnegg 2005; Schnegg 2006a; Schweizer 1996; Schweizer 1997; Ziker and Schnegg 2005).

Even though local exchanges and global structures have been in the focus of anthropology for quite some time, little is known empirically about the relationship. White and Johansen were the first to demonstrate some of these micro-macro linkages in a Lévi-Straussian approach to kinship studies (White and Johansen 2004). Landa, an economist, reinterpreted the classical Kula Ring and hints at the power of explanations that link exchange norms on the micro level with macro structures. Her explanation builds on two fundamental axioms: the spatial location of the islands and positive transaction costs. Transaction costs include the costs of traveling and building alliances. Landa shows that if traders want to minimize the costs and maximize the number of islands directly and indirectly linked to, they have to trade with two adjacent islands. If all actors apply this strategy then the ring structure that Malinowski observed emerges (Landa 1994: 141pp).

The question of how complex patterns emerge from local exchange recently gained a major boost from work done outside of the social sciences: in physics (Barabasi and Albert 1999; Pujol et al. 2005). Since the pioneering publication on the emergence of scaling in networks by Barabasis and Albert in 1999 an astonishing scientific effort has been made to show that complex systems (networks) have an underlying architecture that is governed by similar principles. The new and fast growing discipline of network science has proved that large networks as diverse as connections between neurons in a nematode worm, the predator-prey relations between species in food webs and the linkages between web sites show one fundamental property: they are *scale free* (Albert 2001; Barabasi and Albert 1999; Barabasi 2002; Montoya and Solé 2002; Newman 2003).

Scale free characterizes the distribution of linkages in a network. *Scale free* networks are dominated by a few hubs; nodes with a very high degree. In contrast the vast majority of nodes have very few links. These structures prove to be very efficient in connecting a random pair of nodes with few links. Barabasi and Albert identified the exchange rule that leads to a *scale free* typology as "preferential attachment". In a growing network nodes that are already well connected are more likely to attract new linkages: the well connected become better connected; the rich get richer (Barabasi 2002).

Demand Sharing in a Namibian Community

This article analyzes sharing among the Damara and Nama people in north-western Namibia in the light of these new insights about the emergence of order. The data presented here were collected during 18 months of field work among the Damara and Nama people in Fransfontein, a rural community in north-west Namibia. The fieldwork was carried out by my wife, Julia Pauli (University of Cologne), and I on equal terms as part of the collaborative research project "Kultur- und Landschaftswandel im ariden Afrika (SFB 389)" funded by the German National Science Foundation (DFG). Fransfontein is a settlement area and consists of 137 households. The surrounding landscape is dotted with small settlements of 3 to 15 houses. They group around permanent water holes. In the semi- arid environment with annual rainfalls below 250 mm natural resources are scarce, scattered and unpredictable. The Damara and Nama people are Khoekhoegowab speakers. Khoekhoegowab is a Khoisan language that is primarily spoken in Namibia, Botswana and South Africa. Both ethnic groups make a very similar living today. Small stock farming, wage labor on commercial farms, state welfare (pension payments), employment in the public sector and remittances from relatives in the urban centers make up the largest proportion of the household income. Households often mix different livelihood strategies to buffer risk and to reduce their social vulnerability. The majority of households live with a daily income below one Euro.

Demand sharing (*augu*) is a vital part of everyday life in Fransfontein. It provides the most flexible share of goods consumed by a household. People in Fransfontein use a wide range of different words to refer to different transactions. The Khoekhoegowab word *au* means to give. *augu* literarily describes the relationship between two people established through *au*. With *au* the giver does not expect the item to be returned. This is different with two other types of sharing, ma or */khuwi*, where the good is expected to be returned. At mealtimes households can expect a neighbor's child to pass by and to confront the household with the demand: "*Au te re sugari!*" (Give me some sugar!). The household who sent the child then neither has sugar nor cash to buy it in the local stores. Sugar is one of the most important energy components of the diet. If the household who is asked to share currently possesses sugar there exists a strong normative expectation to share some of it. The quantity given is usually a cup, about 150g (600 kcal). Besides food (maize meal, sugar and milk) *augu* exchanges include to a much lesser extent non-food items such as firewood, washing powder, tobacco and snuff.

Data

During 10 days of our fieldwork we collected information on all the *augu* transactions of 62 households. Households were not selected randomly. Rather, we tried to maximize the variation within the sample and selected households from different types of living conditions (settlement area/ farm) and different economic backgrounds (with and without regular wage income). We interviewed each household on a daily basis and recorded the *augu* transactions over the previous 24 hours. Some of the interviews where done by local assistants and some by the lead researchers. The interviews took on average 10 to 15 minutes a day. The 62 households reported a total of 1740 *augu* transactions over the complete period of 10 days. These individual transactions were aggregated over the complete time period to compile the social network data analyzed below.

After this initial round of interviews we entered the data into the computer and generated a second questionnaire for each household, to collect socio-demographic information about ego and its alters. In addition to this quantitative data almost by necessity as part and parcel of participant observation we participated during the 18 months of our stay in Fransfontein in *augu*. Linguistic and cognitive data on the significance of different types of exchange relationships complement the behavioral information.

Exchange rules

A range of different hypotheses have been proposed to explain why people share food and other goods in small scale societies. Here we focus on the two most prominent ones: kinship and reciprocity. In the evolutionary debate the kinship hypothesis is a part of the fitness theory that formulates that an actor is willing to share with a relative because s/he would eventually profit from the greater reproductive success of relatives. Hamilton proposes that actors should be willing to share with kin, when the cost (C) to the giver is smaller than the benefit (B) to the recipient times the coefficient of relatedness (r) that describes the genetic relationship between both actors ($C < B \times r$) (Hamilton 1964). A number of empirical studies have provided empirical evidence for the kinship hypothesis (Betzig and Turke 1986; Schweizer 1997; Ziker and Schnegg 2005).

The kinship hypothesis is relatively unproblematic to test empirically. I restricted myself for comparative purposes to consanguineal kinship.[1] To reconstruct the kinship coefficient we recorded for all

1 This does not mean that affine links are less important in Fransfontein but the evolutionary models discussed above are usually restricted to consanguineal kinship.

62 informants and their household members their ancestors as far back as the informants remembered. These data were submitted into the software Descent to compute Wright’s coefficient of relatedness (Hagen 2004). The output is analogous to the sharing matrix. Cells of the matrix show the relationships between all the people in the 62 households. This matrix was aggregated on the household level to contain information about the average kinship coefficient between any two households in the sample. To test whether the two matrices are correlated a matrix permutation test (QAP, Quadratic Assignment Procedure) is used (Hubert and Schulz 1976). QAP provides two statistics: the Pearson product-moment correlation coefficient between the two variables and an estimated level of significance. Since the entries in a matrix are not independent common tests of significance are not applicable. The procedure therefore reshapes the matrix row and columnwise and correlates it with the dependent variable. It does this many thousands of times and reports the proportion in which the observed correlation was as high as the correlation between the simulated matrixes. Demand sharing and the kinship network are significantly correlated: r=0.139, p=0.000.

Unlike the kinship model, reciprocity does not require assumptions about the genealogical relationship between the sharing partners. Direct reciprocity involves some level of trust and creates the problem of free riding (Ostrom 2003). It is most likely to work in small groups where repeated interactions are highly likely (Axelrod 1984).[2] Each of the 62*61/2 (=1891) dyads between the 62 households can have either of the four states: the null state (*a <-!-> b*), the reciprocal state (*a <–> b*), and either of two asymmetric states (*a –> b* or *a <– b*) (Holland and Leinhardt 1970)[3]. The *augu* network has 58 reciprocal, 80 asymmetrical and 1753 null dyads. The proportion of reciprocal ties is higher than Ziker and Schnegg reported for Dolgan and Nganasan i.e. 26 ties were reciprocal and 58 asymmetrical. One strategy to examine the significance of the observed distribution is the use of simulations. Snijder has developed a simulation model to test the significance of the dyadic census. The model conditions density and degree distribution. We ran 10,000 simulations to estimate a random level of reciprocity for comparable data sets. The models estimate 7.5 (s.d. 2.5) as the number of reciprocal ties that would be expected by chance. The observed value is almost eight times higher! These results clearly indicate that *augu* is reciprocal.

Network Structures

Networks emerge if many dyadic relationships are viewed as a whole. The network of exchanges among the 62 households is shown in Figure 1. The position of the nodes does not reflect their geographic location. Rather, they are aligned so that nodes which exchange regularly are drawn closer together and nodes that have little or no direct and indirect contact are pushed further apart.[4] The graph in Figure 1 contains no isolates. All but two households interviewed are connected through *augu* relationships. If we restrict the measure for connectivity further to k=2 we find that 87.1 % of the households (N=54) still belong to the redundant and cohesively connected “backbone” of the exchange system.

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2 Recently research has extended the notion of reciprocity to indirect reciprocity in which giver and receiver are not the same person anymore (Nowak and Sigmund 2005; Panchanathan and Boyd 2004). I excluded this type of reciprocity from the current analysis.

3 What we refer to as the reciprocal state is also referred to in the literature as the mutual or complete state (Holland and Leinhardt 1970; Wasserman and Faust 1994).

4 The graph was produced with Pajek (Batagelj and Mrvar 2003).

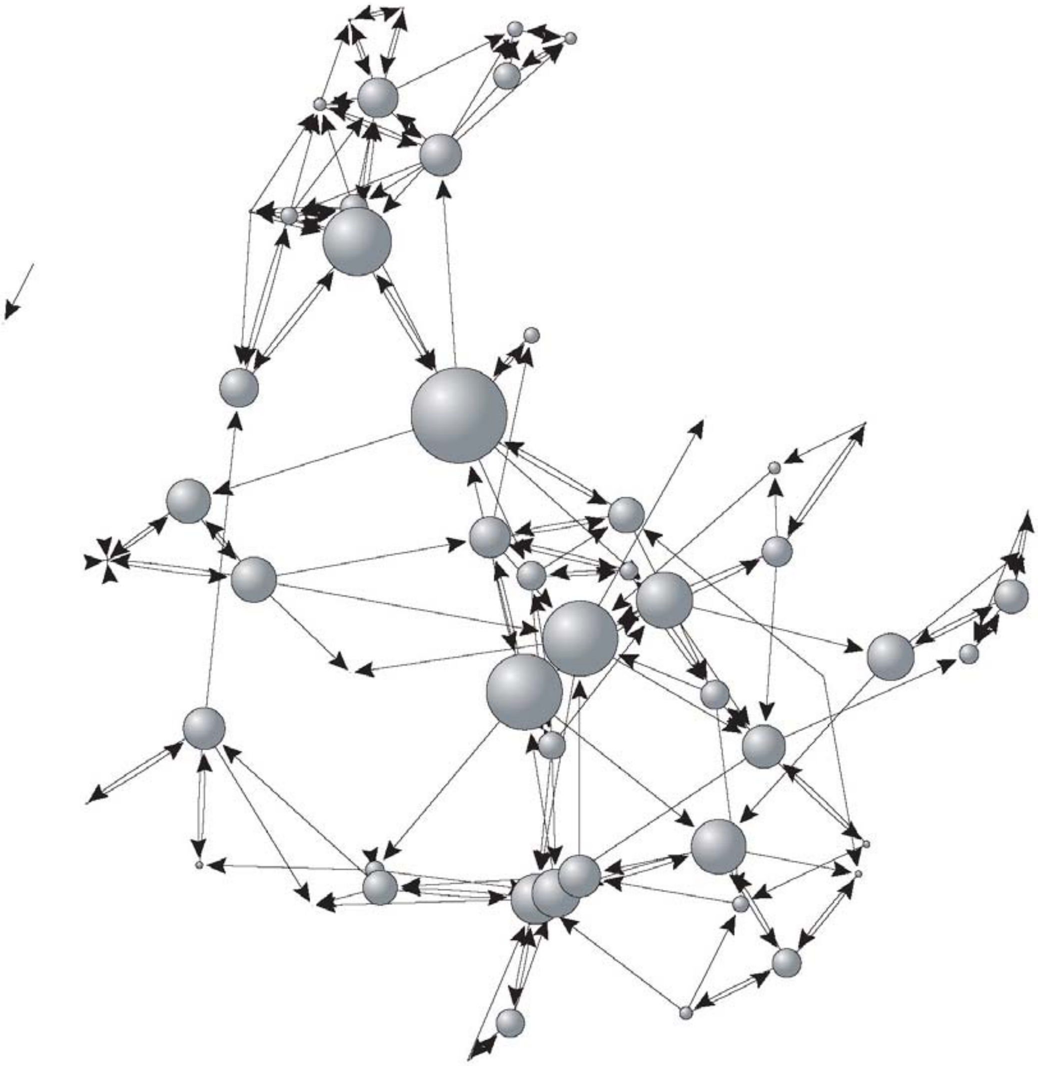

Figure 1: *Augu* Exchange Network

Recent research on the evolution of complex systems has demonstrated that a wide range of networks share one fundamental property: they are *scale free*. Each node in a network has *k* links. *K* is also called the degree of a node. Networks are *scale free* if the degree distribution P(k) follows a power law (P(*k*) ~ *ky*). *Scale free* networks are dominated by a few hubs, nodes with a very high degree (Barabasi and Albert 1999; Barabasi 2002; White and Johansen 2004).

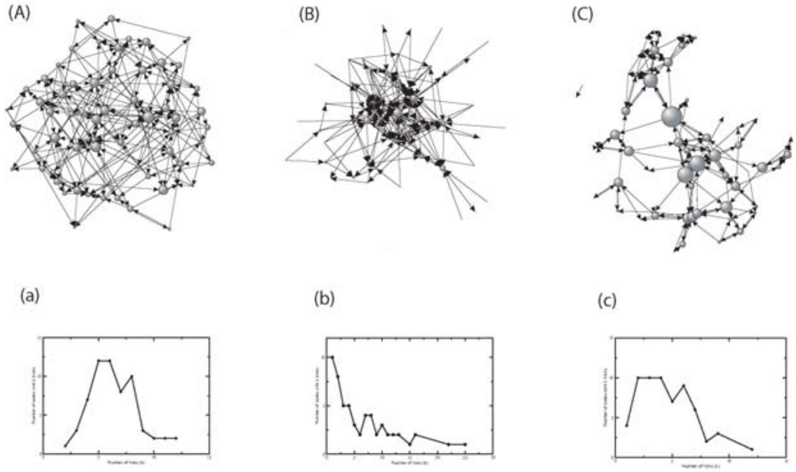

Figure 2: Comparison between different Network Typologies

Figure 2 shows three different networks with 62 nodes and a mean degree of 4.5. The first network (A) is a random network (also called Erdos-Renyi graph). The distribution of links in the network is shown in the graph (a) below the figure. The x-axis of the graph gives the number of links (k) and the y-axis the number of nodes (actors) with *k* links. The distribution shown in (a) has a bell shape. Given the small number of nodes the fit is imperfect but it is clearly visible that some nodes have few ties, many have an average number of connections and again a few have many ties. The second network (B) in figure 2 contrasts with this pattern. This network is *scale free* in a qualitative sense. It is clearly dominated by a centre and some central hubs, even though the number of nodes are much too small to produce a real *scale free* typology. The graph (b) below shows the corresponding distribution of links. Typically for a *scale free* network a few nodes have many links and most have very few. There is no middle group. This distribution is also called a power law distribution. The last graph (C) shown in figure 3 is the *augu* network. Its structure is quite different from the *scale free* network. It is much more decentralized and egalitarian. The graph (c) below supports this impression. The distribution of nodes does not follow a clear power law but rather a mixture of both patterns. As with power law distributions we find some nodes have a lot of links on the left hand side of the graph. However the mode (maximum) of the distribution is not the smallest value, as in a *scale free* network. The left hand side of the distribution is formed like a normal distribution. Later we will use simulations to test how these distributions emerge.

Reciprocity in growing networks

The network structure that emerges from *augu* transactions is not *scale free* but less hierarchical and more robust than a *scale free* graph. Physicists have proposed "preferential attachment" as the underlying principle that produces *scale free* network structures. Social scientists had formulated similar ideas before (Merton 1968; Moreno 1936; Price 1976). The social relationships analyzed in much detail over the last years include co-acting in movies, scientific co-authorships, scientific citations, and sexual relationships (Newman 2001; Newman 2003). I have recently shown that many ethnographic cases typically show a different pattern. They are much less *scale free* or not *scale free* at all (Schnegg 2006b).

The question becomes why *augu* is not *scale free* and what rules can account for the typology we observe? If we translate the rule of "preferential attachment" to the local circumstances it would mean asking those who have already been asked a lot in the past. Given the high degree of economic inequality in a society, that would mean asking those who are better off. While this may be true for some transactions it is not the norm. The norm is to ask those whom you have assisted in the past. The norm is direct reciprocity. We call this model "reciprocal attachment" or reciprocity. In his seminal work almost 50 years ago, Rapoport introduced the idea of studying the effects of reciprocity on network structures. Unfortunately during this time computational opportunities where too limited to put his ideas to test (Rapoport 1957; Rapoport 1958).

The aim of our simulation model is to test what happens when people in a network start playing with a history of previous exchanges in mind instead of only looking after important hubs when choosing new exchange partners. The simulation starts with a loosely connected Erdös-Rényi-type network in which each node picks two partners at random and gives them something (degree=2). In the second step it iterates through 10 rounds of exchanges for each player. The starting condition is different from the seed usually defined in the BA model. In the BA model the starting configuration is a small, fully connected graph. Since we want to allow all nodes to choose partners according to previous exchanges as well, we must define a *status quo* before running the actual simulation. The easiest *status quo* is a random graph. Throughout all 10 rounds of the simulation we allow all 10,000 vertices to select partners to give something to according to one of the following two rules: (1) pick your partner with a probability proportional to its number of incoming links (preferential attachment) or (2) randomly pick one of the players who gave you something in the past (reciprocal attachment). The first choice is made with probability P; otherwise we take the second choice, randomly at each iteration. The resulting degree distributions are stored and averaged over 10 simulation runs.

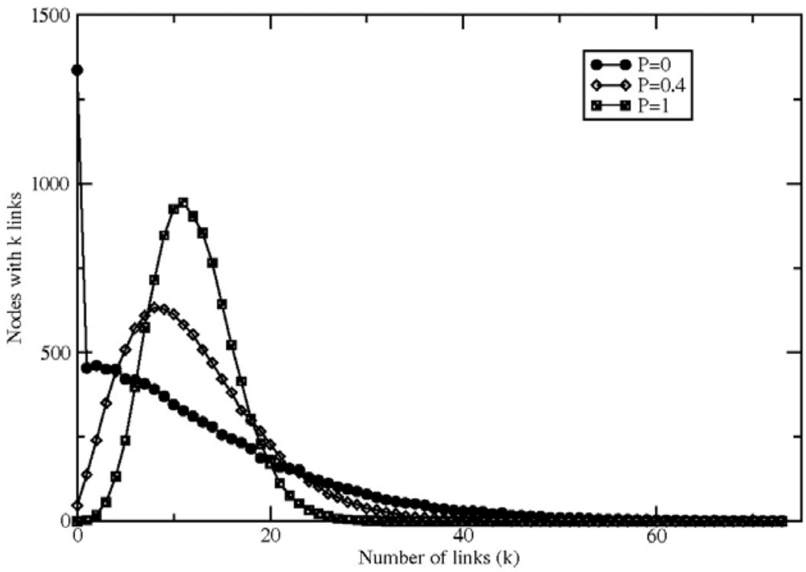

Figure 3: Degree distributions for different models. Results are averages over 10 simulations

Figure 3 shows the degree distributions with varying probabilities P, that actors play reciprocally. The two extremes, P=0 (full BA) and P=1 (full reciprocity), are well known: A power law distribution on the one hand and a Poisson distribution on the other. Effective values of gamma between those two extremes are combinations of the two rules. *Adding only small percentages of the reciprocity rule to the exchange system alters its structure*. The distribution of ties in the *augu* network has a long tail, indicating some hubs. At the same time the mode (maximum) is not the smallest number of links. It combines properties from a Gaussian and a power law distribution. The simulations show precisely how this can emerge: If reciprocity and memory are added as a supplementary rule in the exchange system.

Conclusion

This article focused on principles that govern exchange and the networks that emerge from those transactions. We did this both empirically and through simulations. In Fransfontein these network relations are built and enforced through the relatively strict norm to reciprocate directly. New kinship studies view sharing as a fundamental means to create relatedness. Peterson noted that universal systems of kin classification are a well known characteristic of hunting gathering societies. Although the Damara and Nama do not live from hunting and gathering anymore their kinship terminology is classificatory. Peterson stresses that in a kinship system where ego is formally linked with almost everybody else social practice enforces and reinforces kinship ties. Sharing creates relationships and social order and is much more strategic as a spontaneous demand. It not only minimizes risk but also helps to manage uncertainty. Sharing is also a key element for the production and reproduction of social relations, egalitarianism and the self (Peterson 2002).

The norm of "reciprocal attachment" which we proposed for Fransfontein as a major addition to the "preferential attachment" does not govern all decisions to share. Stratification is pronounced and different households have different needs and different abilities to give. "Preferential attachment" reflects the logic to go and ask where there are more resources to share. If all exchanges were like this they would be one of the hubs in the *scale free* network. However, the more the exchanges are governed by the norm of reciprocity the more likely a network will emerge that matches the institution described here: A network that is largely egalitarian, robust and well connected. A third strong predictor of exchange that we did not look into is geographical proximity. We have seen that if reciprocity is included decentralized networks emerge. The tendency to ask those that are nearby roots these networks in space. The result from these two local exchange rules is the decentralized and localized network that we find *augu* to be. The network structure we observe emerges from these local rules.

Figures

Figure 1: *Augu* Exchange Network

Figure 2: Comparison between different Network Typologies

Figure 3: Degree distributions for different models. Results are averages over 10 simulations

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